CALS TEST NETWORK

CTN Report 93-016

Text Plan To Evaluate Computer-Aided Design Systems for: MIL-D-28000 Compliance with: Additional User Requirements

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Test Plan to Evaluate Computer-Aided Design Systems for MIL-D-28000 Compliance with Additional User Requirements

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1. Scope

1.1. This document serves as a guideline to evaluate computer-aided design (CAD) systems for compliance to reference [1], MIL-D-28000, Digital Representation for Communication of Product Data: IGES Application Subsets and IGES Application Protocols and user-defined requirements[1]. These references define the requirements to be met for product definition data exchange in the format specified in the Initial Graphics Exchange Specification (IGES), reference [2] or [3].

1.2. The user of this test plan, hereafter referred to as "customer", is any DoD activity requesting the evaluation of CAD systems specifying compliance to a class in MIL-D-28000 and to the user-defined requirements. The customer selects the class in MIL-D-28000 to be tested. The decision whether reference [2] or [3] shall be used depends upon the class selected. Some classes specify reference [2] while others specify reference [3]. Reference [4] can be applied whenever reference [3] is specified since IGES is upwardly compatible.

1.3. This test plan may be offered to potential contractors to evaluate their processors if they wish to exchange CAD data in IGES format, compliant to a selected class in MIL-D-28000 and the user-defined requirements, with the customer or other contractors.

2. Overview of Testing Strategy

2.1. The testing of IGES processors, against customer's requirements for compliance to the user-defined requirements and a selected class in MIL-D-28000, shall be accomplished in a two-phased plan using test cases developed and validated according to reference [5], Test. Case Development and Verification Guide for MIL-D-28000.

2.2. Though this test plan addresses the testing against any selected class in MIL-D-28000, it can also be applied to multiple classes. The similarities of selected, multiple classes shall be the criteria against which to test. A

[1]User-defined requirements are additions or deviations from the standard necessary to fulfill the requirements of the digital data exchange program for a specific project.

prohibition of an aspect in one selected class shall be acknowledged as such though the aspect may be acceptable or even encouraged by the other selected classes. Only the "lowest common denominator" between the selected classes shall be acknowledged and applied.

2.3. The first phase, Phase I, focuses on basic concepts exercised in applications pertaining to the selected class in MIL-D-28000. Test cases developed for Phase I shall meet the minimal requirements for that application, according to the user-defined requirements and MIL-D-28000, excluding the representation of the concepts to be emphasized in the particular test case. The purpose of Phase I is to determine whether the CAD system meets the customer's minimal functional requirements and warrants further testing of typical application scenarios found in production. The second phase, Phase II, based on the concepts stressed in the previous phase, addresses production-oriented application scenarios. This phase shall be implemented if the results from the first phase of testing show compliance potentiality of the IGES processors, as determined in Section 5.5. Such an approach insures that CAD systems are thoroughly tested using a wide range of applications common within the military.

2.4. Each phase includes a pre-processor evaluation of a given CAD system. The CAD data base, the CAD system's internal digital representation of user-defined product definition data in a pre-defined structure, shall be constructed according to a detailed, system-generic Data Base Description, provided with the test case, to create or modify entities mapping into IGES entities adhering to the selected class in MIL-D-28000. The applicability of CAD operator commands, used to create or modify the entities in the CAD data base, to the applications or concepts under test, including the degree of correctness and the conformance to MIL-D-28000 and the user-defined requirements of the resulting IGES file, are criteria to be evaluated for compliance. An IGES pre-processor, which complies to the user-defined requirements and the selected class in MIL-D-28000, shall have the facilities to process, as defined by MIL-D-28000, and create an IGES file compliant to the selected class in MIL-D-28000 and the user-defined requirements.

2.5. Post-processor evaluation is also an integral part of testing in each phase. A post-processor under test shall be given an IGES file, provided with a test case,

compliant to the selected class in MIL-D-28000 and the user-defined requirements, the complexity depending upon the phase of testing and the applications or concepts to be emphasized. An Evaluation Script, which details the contents of the generated CAD data base according to its representation in the IGES file, MIL-D-28000, and the user-defined requirements, is included in the test case with a hard-copy plot(s) of the graphical representation(s) of the data represented in the test case. Completeness, accuracy, visual equivalency, and functionality of the resulting CAD data base compared to the Evaluation Script and plot shall be checked. All entities not processed and other discrepancies found in the CAD data base, affecting the visual or functional definition of the intended outcome according to MIL-D-28000 and the user-defined requirements shall be reported. A conforming IGES post-processor shall be able to correctly process **any** IGES file, compliant to MIL-D-28000, the user-defined requirements, and the information represented in the IGES file.

2.6. A process flow chart depicting the procedures to be followed to conduct testing of IGES processors is provided in Appendix C of this test plan. The chart merely provides an overview of testing procedures; it shall not replace the main body of this document as the procedures to be followed. It does not provide specific procedural detail and does not designate responsibility of tasks to members on the testing staff to which the main body does convey.

2.7. This document refers to system user input by such phrases as "CAD operator command", "command line syntax", and "instruction". These terms refer not only to textual input, meaning entry of ASCII characters via keyboard, but to icon selection and any other form of operator input. If non-textual input, such as icon selection, is performed, the system interpretation mapped to this input shall be noted wherever user input is to be recorded. These instructions are not meant to preclude automated methods such as macro programs, direct data base manipulation, scripts, etc.

3. Resources

The following resources are the minimum recommended for testing to proceed:

- CAD Operator
  - shall have the following qualifications:
    - understanding of IGES and the ability to correctly identify sections and entities in an IGES file without any supporting documentation;
    - understanding of MIL-D-28000, especially Sections 1.0 (Scope), 2.0 (Applicable Documents), 3.1 (General Requirements), 4.0 (Quality Assurance Provisions), 6.0 (Notes), and the section pertaining to the selected class;
    - thorough understanding of the user-defined requirements;
    - enough experience with the CAD system under evaluation to be able to create a CAD data base representing a selected application without any difficulties due to skill;
  - shall perform the following duties:
    - compile the necessary CAD operator commands, including alternates when specified, to create or modify selected entities;
    - prepare and create the CAD data base;
    - pre-process the CAD data base and post-process the IGES file according to the instructions provided by the vendor representative;
    - record data base creation and processing events as requested by this test plan in the incident log;
    - appraise the applicability of CAD and IGES entities to implement an intended function according to the system documentation, MIL-D-28000, and the user-defined requirements, when needed;

- Customer Representatives
  - appointed by the customer, with the following qualifications:
    - management of CAD projects, composed of various applications, especially the selected application, for the customer;
    - five years of experience as a CAD manager or user;
    - thorough understanding of this document, MIL-D-28000, and the user-defined requirements;
    - knowledge of the customer's requirements;
  - shall perform the following duties:
    - appoint the CAD system administrator;
    - furnish the CAD system to be tested with its appropriate hardware platform if they are owned or licensed by the customer;
    - furnish IGES file analyzers with appropriate hardware;
    - analyze the customer's requirements to determine prioritized application needs;
    - select and analyze application concepts and scenarios to be tested;
    - select and obtain test cases, and can specify the creation of new test cases;

  - approve the findings by the testing administrator of technical errors or limitations in test cases;
  - notify the vendor of an IGES file analyzer of any discrepancies found with IGES file analysis;
  - determine, with the testing administrator, if the CAD system shall continue to be tested by examining its test results compiled thus far;
  - determine if testing shall proceed depending upon the results generated from IGES processor analysis;
  - determine the value of non-compliances of the CAD system to the customer;
  - receive test reports;
  - receive data base creation, modification, and processing; procedures for the tested and qualified CAD system from the testing administrator, and distribute this information to qualified end users of the CAD system;

- CAD System Administrator
  - appointed by the customer representatives, with the following qualification:
    - one year of experience with the hardware platform and the operating system environments of the CAD system and the IGES file analyzers;
  - shall perform the following duties:
    - install and manage the CAD system to be tested with its required hardware platform;
    - install, if not done previously, the automated IGES file analyzers with appropriate hardware specified by the testing administrator;

- Testing Administrator
  - appointed by the customer, with the following qualifications:
    - thorough understanding of this document and reference [5];
    - thorough understanding of MIL-D-28000 and the user-defined requirements;
    - previous experience in testing CAD/IGES processors;
  - shall perform the following duties:
    - review the test case for completeness, accuracy, and applicability;
    - resolve conflicts and concerns, or propose resolutions to them, that arise during testing;
    - determine, with the customer representatives, if the CAD system shall continue to be tested by examining its test results compiled thus far;
    - specify the automated IGES file analyzers to assist in the evaluation of IGES files during testing;
    - manage the completion of test reports with help from the CAD/IGES evaluators;
    - compile and deliver to the customer representatives

procedures for creating and pre-processing a CAD data base and post-processing a compliant IGES file on this CAD system;

- CAD/IGES Evaluators
  - appointed by the customer, with the following qualifications:
    - two years of experience with testing or performing analysis on a variety of CAD/IGES processors;
    - thorough understanding of this document, MIL-D-28000, IGES, and the user-defined requirements;
    - working knowledge of the CAD system under test in order to be able to create, modify, and query the data base;
    - thorough understanding of IGES to be able to correctly identify sections and entities in an IGES file without any supporting documentation;
  - shall perform the following duties:
    - determine the accuracy and completeness of the data generated during each phase of testing according to source data, the selected class in MIL-D-28000, and the user-defined requirements;
    - assist the testing administrator to complete test reports;

- Vendor Representative
  - appointed by the vendor of the CAD system under test and shall perform the following duties:
    - provide instructions to pre-process a CAD data base and to post-process an IGES file according to the user-defined requirements and to the selected class in MIL-D-28000;
    - review and approve CAD operator commands, including alternates, in writing recorded in the incident log, in context of the applied application concepts or scenario, submitted by the CAD operator;
    - provide the CAD/IGES entity mapping scheme pertinent to the CAD system under test;
    - provide the CAD system under test and/or its hardware platform if not furnished by the customer representatives;

- CAD system under test including CAD/IGES processors and all hardware required to support testing, including all software and hardware user documentation, provided by the customer representatives or the vendor representative as specified in the role definitions in this section;

- CAD/IGES entity mapping scheme specifying the CAD entity/IGES entity mappings for pre- and post-processors including limitations, provided by the vendor representative;

- conceptual (Phase I) and application (Phase II) test cases, each comprised of a Purpose, an IGES file, a Data Base

Description to create the CAD data base, an Evaluation Script, and a plot, created and validated to the guidelines as specified in reference [5];

- IGES file analyzer tools and appropriate hardware[2];

- incident log to record all events as specified:
  - CAD system misinterpreting correctly selected and entered CAD operator commands;
  - generation of extraneous IGES entities which are not volunteer entities;
  - generation of warning and error messages by IGES file analyzer software;
  - discovery of concepts pertaining to the selected application which are not supported by the CAD system under test;
  - CAD/IGES processor failures during translation;
  - discovery of non-conformities to the selected class in MIL-D-28000 or the user-defined requirements in a CAD/IGES processor;
  - discovery of missing, displaced, or incorrectly processed CAD entities;
  - discovery of CAD operator errors which occurred during CAD data base creation or modification or during pre- or post-processing;
  - absence of entity functionality in a post-processor-generated CAD data base;
  - perception of limitations and errors in MIL-D-28000 or the user-defined requirements[3];
  - specification of alternate CAD operator commands;
  - evaluation of the severity of each incident hindering the compliance of the CAD system to the user-defined requirements and the selected class in MIL-D-28000, including the vendor representative's proposal to resolve each issue;
  - all approvals where noted;

  detailed descriptions of these events are recorded in the appropriate sections of this document; Appendix D shall be consulted to obtain the format of an incident log;

- instructions, provided by the vendor representative, to pre-process a CAD data base and to post-process an IGES file generating output complying with the selected class in MIL-D-

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[2]A list of such tools may be obtained on CERCNet, a public bulletin board system sponsored by West Virginia University

[3]Any perceived limitations or errors discovered in MIL-D-28000 shall be reported using DD Form 1426.

28000 and the user-defined requirements;

- the entity usage log for the CAD system under test; Appendix E shall be referred to on creating and completing an entity usage log;

- customer's requirements, analyzed by the customer representatives to determine prioritized CAD application needs as applied to test case selection, shall include the following:
  - time and funds for testing and developing test cases;
  - projected frequency of receiving and generating IGES files in production for each application scenario;
  - time span when the customer may need to address each application scenario in the form of an IGES file or a CAD data base in production;
  - several hard copies of plots, representing a range of application scenarios, generated or received by the customer in production.

4. Preparation for Testing

4.1. The testing administrator shall prepare the incident log, according to criteria specified in Appendix D to enable the recording of approvals, events, etc. wherever noted in this document. The recording of such events shall be in the format and include information also specified in Appendix D.

The testing administrator shall also prepare the entity usage log as documented in Appendix E. This log shall comprise of information on the applicability of CAD operator commands on CAD entities into IGES. It shall be completed according to this Appendix when indicated in this test plan.

4.2. The customer representatives shall classify the customer's hard copies of plots into application scenarios. The representatives shall designate the scenarios in any manner they feel to be appropriate. Reference [6] contains abstracts, which include book-form plots, of test cases. These hard copies shall be examined against the abstracts of these existing test cases applicable to the specified application scenario. This process shall determine if any existing test cases meet the requirements for the customer's applications. The following criteria shall be considered to determine if an existing test case shall be used:

- cost and time savings using an existing test case;
- the value of each attribute not or insufficiently represented in the test case for the customer.

The precedence of each criterion depends upon the needs of the customer. If applicable test cases do exist, the customer representatives shall determine which test case satisfies the customer requirements most comprehensively.

4.3. The customer representatives shall prioritize these application scenarios from most critical to the customer's requirements to the least. Some scenarios may be given equal prioritization. These scenarios shall be ordered using the following criteria:

- time and funds to spend developing a test case, if needed as determined in Section 4.2, and testing;
- the time span when the customer may need to address each application scenario in the form of an IGES file or a CAD data base in production mode;
- frequency of occurrence the customer may be exposed to each application scenario in the form of IGES files, compliant to the user-defined requirements and the selected class in MIL-D-28000, or CAD data bases during production;
- complexity of each application in the number of different IGES and CAD entities used and the complexity of the entities themselves; the CAD operator, with assistance from a mathematician if needed, shall be responsible for appraising the complexity of each candidate CAD or IGES entity depending on the mathematical complexity of manually determining the values of all fields of an IGES entity given data supplied to an operator, via a query mechanism, of the CAD entity mapping to it, and vice versa, according to the CAD system documentation or IGES.

The precedence of each criterion depends upon the needs of the customer.

4.4. The customer representatives shall determine and prioritize concepts applicable to Phase I testing. These concepts shall be derived from MIL-D-28000 and/or other appropriate resources. The concepts shall be standard structures and practices found many instances of the application addressed by the selected class. The customer representatives shall decide which concepts need to be tested. Reference [6] should be consulted to determine if any existing Phase I test cases are satisfactory. The concepts tested shall be

stressed in Phase I test cases to limits in size and/or amount which can be encountered in production and are acceptable by MIL-D-28000 and the user-defined requirements. The concepts to be tested shall be selected and prioritized according to the following:

- their commonality among different application scenarios;
- their influence on defining the structure or information content of the selected application, both in the data base and on hard copy;
- their degree of emphasis in existing Phase I test cases;
- resources allocated;
- time and funds to create a new test case to stress these concepts if all existing test cases do not satisfy these criteria.

References [1] through [6] can assist in determining these influences.

The selection and prioritization of these concepts enables the more pertinent concepts to be stressed in Phase I test cases before less pertinent concepts. For example, suggested concepts for Class II of MIL-D-28000, engineering drawing applications, are:

- dimensions;
- various drawing sizes;
- sectioned views, including use of various crosshatching patterns;
- parts list;
- text notes;
- color;
- line weight;
- line font;
- layering scheme;
- title blocks;
- various formats;
- data relationships, including subfigures;
- feature control symbols;
- model, drawing, and view relationship;
- tolerances;
- multiple engineering drawings.

All concepts are candidates if they are considered pertinent to represent or support the representation of the application selected by the customer. The concepts can be aggregated according to functionality. For example, a test

case can include arcs and/or lines with different fonts, weights, and colors to stress various entity attributes. Also all concepts may be evaluated in a single test case for budgetary reasons.

4.5. The CAD system administrator shall install and manage the hardware and software environment for testing to proceed. The hardware and software under test shall be provided by the vendor; other hardware and software shall be provided by the customer. If the software has already been installed, it shall be certified by the vendor, and if required, re-installed to eliminate all user enhancements and customizations. This environment comprises of all hardware, software, and user documentation to create and modify the desired digital data base, to pre-process a CAD data base generating an IGES file, to post-process an IGES file generating a CAD data base, and to analyze IGES files. The CAD system and its hardware platform shall be provided by the customer representatives if they are owned or licensed by the customer. If not, they shall be provided by the vendor representative. The customer representative shall provide the automated IGES file analyzers, specified by the testing administrator, and the appropriate hardware. The CAD system administrator shall install the IGES analysis software, if this has not been done. The vendor representative shall witness and approve, in writing recorded in the incident log, the establishment of this system. Any reservations shall be presented to the testing administrator for resolution. All resolutions shall be finalized before Phase I testing proceeds.

4.6. IGES file analyzer software shall be evaluated to test their claims of capability to examine IGES files against indicated specifications such as IGES and MIL-D-28000. This test plan does not provide a methodology to perform this task. A methodology should be developed, tested, and implemented to evaluate IGES file analyzer software, selected for testing IGES processors, before proceeding with actual processor testing.

5. Phase I Testing Scheme

5.1. Pre-processor testing shall proceed as follows:

5.1.1. The customer representatives shall obtain the proper test case based on the prioritization and/or aggregation of the concepts germane to the selected application as determined in Section 4.4. If an

appropriate test case is not available, the customer representatives shall consult reference [5] to create such a test case, with written approval by the testing administrator recorded in the incident log. Any test case developed shall be completed by a date designated by the customer representatives. All test cases shall be or have been developed and validated according to test case development and validation procedures presented in reference [5]. All new test cases developed and validated shall be delivered to the CALS Test Network (CTN).

5.1.2. The testing administrator shall review the test case to determine if it thoroughly meets the needs of the customer. If it does not, another test case shall be obtained abstracted in reference [6]. If an appropriate test case is not available, the customer representatives shall consult reference [5] to create such a test case, with written approval recorded in the incident log by the testing administrator.

5.1.3. The testing administrator shall thoroughly review the test case for all errors and inconsistencies. A test case is comprised of a Data Base Description, an IGES file, a plot(s) of each pictorial representation(s) of the data base, and an Evaluation Script. The following criteria shall be considered during review, within the user-defined requirements and the requirements specified in MIL-D-28000 and reference [2] or [3]:

- the Data Base Description completely reflects the concepts to be emphasized in this test case, to the extent permitted by MIL-D-28000, the user-defined requirements, and reference [2] or [3];
- the IGES file is in the correct ASCII format per reference [2] or [3];
- the IGES file correctly and completely reflects the Data Base Description;
- the IGES file thoroughly and correctly represents the concepts to be emphasized and contains the required entities for the selected application, per the user-defined requirements and MIL-D-28000;
- the plot correctly and completely pictorially reflects the data base as defined by the IGES

file;
- the Evaluation Script completely reflects the concepts to be emphasized in this test case;
- the Evaluation Script is correctly and completely reflected in the IGES file.

If any technical errors were discovered with the test case, the testing administrator shall, with concurrence from the customer representatives, correct the test case and proceed with this section. The testing administrator also shall send to the CTN the suggested modifications with the rational on a DD Form 1426. The CTN shall review these suggestions while it is being applied to processor testing. If the CTN found any technical errors with the modified test case which may effect the outcome of testing, the CTN shall notify the testing administrator. Testing shall be repeated, nullifying the previous test results, applying the approved test case.

If the only errors in the test case are grammatical and shall not technically affect the outcome of the testing, the testing administrator shall correct the test case and continue with this section. The testing administrator shall send the suggested modifications on a DD Form 1426 to the CTN, as indicated in the previous paragraph.

5.1.4. The CAD operator shall compile the pertinent CAD operator commands that create or modify any geometry, structure, or annotation needed to stress the tested concepts and a required framework of the application, if any, according to the selected class in MIL-D-28000 and the user-defined requirements. A mathematician may be consulted if the arithmetic complexity is beyond the scope of the operator's capabilities. If there is more than one method of creating or modifying a particular aspect of the CAD data base or if the construct is not supported by the CAD system, the selection of the most appropriate procedure shall depend on the following criteria, listed in order of precedence:

- most accurate representation of data in CAD data base and IGES, according to vendor documentation and the CAD/IGES entity mapping scheme;
- most acceptable CAD/IGES mapping scheme

according to MIL-D-28000 and the user-defined requirements.

The selected method shall be included in the compiled list of CAD operator commands. If the selection was due to an unsupported construct, it shall be noted as such in the incident log.

Each of these CAD operator commands shall produce or modify a CAD entity(s) mapping into an IGES entity(s), according to its CAD/IGES entity mapping scheme, if its contribution in representing product definition data in the IGES file is valid according to the selected class in MIL-D-28000 and the user-defined requirements.

5.1.5. The vendor representative shall review this compiled listing, if this pre-processor has not been tested against these concepts previously. If the pre-processor is being re-tested due to the discovery of non-compliance to MIL-D-28000 or the user-defined requirements, the representative shall review the proposed alternate CAD operator command(s). If the representative finds any objections to this list or to the alternate, he/she shall address them in writing to the testing administrator. An approval of the commands shall be in writing recorded in the incident log. The testing administrator shall revise this list and re-submit it for review by the vendor representative before testing proceeds.

5.1.6. The CAD operator shall initiate an audit trail to record all user input entered via any input device, automatically if provided by the facilities or manually if not.

5.1.7. The CAD operator shall create the CAD data base according to the Data Base Description included in the test case. The CAD data base in generation shall be queried for the result of the previous CAD operator action after each creation or modification of a CAD entity, whether it be geometry, annotation, or structure, and shall be compared with the intended result noted in the Data Base Description pertaining to this modification or creation. This will insure that all CAD operator actions are correctly executed, according to the Data Base Description and the CAD system

documentation, and that the CAD system interpreted these actions correctly. The data base in generation shall also be copied to the disk, referenced by the file name assigned by the operator, every fifteen minutes. If a CAD operator error occurs which appeared to modify the data base, the data base shall be restored to its state prior to the unintended modification and then its construction be continued. This error shall also be noted in the incident log. If the CAD system misinterpreted a CAD operator command, according to software documentation supplied by the vendor, the CAD operator shall note the following in the incident log:

- exact instruction entered by the CAD operator resulting in this misinterpretation
- the intended result of the entered command according to vendor documentation provided with the CAD system
- how the CAD system actually interpreted the entered command, including the results of the data base query
- the CAD operator command to query the data base.

If the test cannot continue after such an error occurs, the CAD operator shall exit from the data base without saving any changes since the last save. The CAD operator shall document this action in the incident log and continue with Section 5.3.

The Data Base Description can be applied to any CAD system and do not intentionally reference any particular CAD system. If any of the concepts cannot be adequately tested, according to the Data Base Description, due to lack of support by the CAD system, the CAD operator shall note the unsupported attributes as such in the incident log. All such incidents shall be considered during system evaluation.

5.1.8. The CAD operator shall save the CAD data base once completed so it can be pre-processed.

5.1.9. The CAD operator shall pre-process the CAD data base according to the instructions provided by the vendor representative. The CAD operator also shall instruct the processor to generate a file

containing processing messages, referred to as a message log file, if this capability is provided.

The processor should not abort for any reason due to information represented in the CAD data base. If it does abort, the CAD operator shall note this failure in the incident log including all messages found in the message log file and all processor messages generated for CAD operator notification. This incident shall be considered during system evaluation. Testing shall proceed to Section 5.3.

5.2. The accuracy and completeness of the IGES file shall be determined by the CAD/IGES evaluators, with assistance from a mathematician where needed, as follows:

5.2.1. The IGES file shall be examined for syntactic compliance to the selected class in MIL-D-28000 as well as to reference [2] or [3]. Since the format of the Start Section is not defined in MIL-D-28000, it may have to be examined manually. All warning and error messages generated by the analyzer shall be recorded in the incident log.

5.2.2. The IGES representation of each concept under test shall be examined for compliance to the selected class in MIL-D-28000 and the user-defined requirements in the following realms:

- syntactical correctness;
- appropriate selection of IGES entities.

All characteristics found in the IGES file hindering compliance shall be noted in the incident log. The IGES entity type, the Directory Entry or Parameter record number, the questioned field's (or fields') position in the record, its value, and the reason why the value does not comply with references [1], [2], or [3] or the user-defined requirements shall be included.

5.2.3. The IGES representations of the concepts under test shall be examined against the original CAD data base, applying requirements specified in the selected class in MIL-D-28000, the user-defined requirements, and reference [2] or [3], in the following areas:

- acceptance of the system-specified minimum

resolution (Global field 19 in the IGES file) depending on the mathematical precision needs of the concepts emphasized in this test case and the smallest exponent applied during data base construction;
- accuracy of the coordinate data in each selected IGES entity according to the system-specified minimum resolution (Global field 19 in the IGES file) and its mapped CAD entity in the data base;
- accuracy of entity transformations, using IGES entity 124, compared with their representations in the CAD data base;
- accuracy of such entity attributes as font, color, weight, and level;
- retention of functionality of CAD entities in their IGES representations;
- correctness of entity mappings according to its CAD/IGES entity mapping scheme.

5.2.4. The CAD operator commands, which created or modified entities successfully mapping into entities in the selected class in MIL-D-28000 with appropriate Parameter and Directory Entry values, shall be noted under the COMMAND column in the APPLICABLE section of the entity usage log, according to Appendix E, if not previously been noted for the creation or modification of the same CAD entity during previous testing of this IGES processor. Each shall be entered in the CREATE subsection if the command created the CAD entity or in the MODIFY subsection if it modified the entity. The names of the CAD entity types, whose entities were processed accurately according to the selected class in MIL-D-28000 and the user-defined requirements, shall be specified alongside each command in the ENTITIES column. These commands shall be used by the CAD operator for testing how the CAD system implements and translates other concepts and in the following phase when and if needed.

5.2.5. The CAD operator commands, which created or modified entities which were not successfully processed into the expected IGES entities in the selected class with appropriate Parameter and Directory Entry values, shall be noted in the entity usage log in the NOT APPLICABLE section in the suitable subsection. If the command's intent,

in this erroneous context, was to create a CAD entity, the command shall be entered in the CREATE subsection under the COMMAND column. If the intent is to modify a CAD entity, the command shall be entered in the MODIFY subsection under the COMMAND column. The reporting of such commands prevents their use in the same context in the future. If a command was APPLICABLE to certain entities but NOT APPLICABLE to others, separate entries shall be created for both APPLICABLE entities and NOT APPLICABLE entities. The commands which were misinterpreted by the CAD system, as recorded in the incident log, shall be included also. Each entity type, whose entities were not processed accurately according to the selected class in MIL-D-28000 and the user-defined requirements, shall be noted, in the manner specified in Section 5.2.4, alongside its applicable command under the ENTITIES column.

5.2.6. All IGES entities which do not map to any CAD entities in the data base, according to its CAD/IGES entity mapping scheme, shall be noted and classified in the incident log as excessive entities or volunteer entities.

5.3. The CAD operator shall proceed with testing as follows:

5.3.1. The IGES file shall be loaded onto the hardware platform of the CAD system under test. If the processor or its operating system environment cannot accept the file, formatted in ASCII per reference [2] or [3], testing shall proceed to Section 5.5.

5.3.2. The IGES file, accompanying the test case, shall be post-processed according to the instructions provided by the vendor representative. A message log file shall be generated if the processor provides the option. All errors and warnings shall be noted in the incident log.

5.3.3. The processor should not abort for any reason due to information represented in the IGES file. If it does abort, this failure shall be noted in the incident log, including all messages generated by the processor, and testing shall proceed to Section 5.5.

5.4. The CAD/IGES evaluators shall inspect the CAD data base for inconsistencies as follows:

5.4.1. The CAD data base shall be accessed to visually evaluate its graphical representation. If the data base requires any preparation before it can be pictorially depicted and accessible for modification, this preparation shall be performed and recorded in the incident log. The resulting graphic representation of the CAD data base shall be compared against the appropriate plots provided. The names of all CAD entities which are missing, displaced, or incorrectly processed, according to the graphical representation, shall be noted in the incident log. How the entity was misprocessed (e.g. missing, displaced, geometrically incorrect) shall also be noted.

5.4.2. The data base representation of the entities, described in the Evaluation Script, shall be compared against these descriptions in the following areas:

- acceptable CAD entity representation of mapped IGES entity(s) per the selected class in MIL-D-28000 and the user-defined requirements;
- acceptable coordinate location of the entities in the data base, within the minimum resolution specified in the IGES file (Global field 19), according to requirements specified in the selected class in MIL-D-28000 and the user-defined requirements;
- acceptable entity attributes such as for line font, color, weight, and level according to the user-defined requirements and the selected class in MIL-D-28000.

All examined entities which were not processed according to these criteria and the aspects in which they were processed inaccurately shall be noted in the incident log as such. The entity type of each misprocessed IGES entity, the DE number, and coordinate locations with their roles defining the placement of the entity (e.g. endpoint, center) shall be included. All entities from which such information could not be derived shall be noted in the incident log also. The command syntax of the system-supplied entity query tool shall be recorded in the incident log as such.

5.4.3. The functionality of the entities noted in the Evaluation Script shall be evaluated. The manipulation of these entities shall include the following operations in different view environments if the CAD system possesses these capabilities according to system documentation provided by the vendor representative, for example:

- creating and deleting entities;
- moving entities (on same level, to different levels, to different Z planes);
- editing entities (changing endpoints, trimming, deleting, exploding--subfigures only);
- modifying characteristics (font, height, weight, color, size);
- analyzing the effects of these actions on other entities independent of or dependent on this subjected entity.

All operations which were not successfully completed, but should have been according to the claimed capability of this CAD system, shall be recorded in the incident log. The CAD entity, on which the unsuccessful operation was performed, and its location shall be noted also.

5.4.4. Control shall be returned to the operating system environment without saving any modifications to the CAD data base.

5.5. The CAD/IGES evaluators shall evaluate the results, obtained in Sections 5.1 through 5.4, against criteria found in the selected class in MIL-D-28000 and the user-defined requirements in the following manner:

5.5.1. The cause for each error or warning message generated from the IGES file analyzers and each error or limitation discovered during manual review, as recorded in the incident log, shall be classified as one of the following and then resolved accordingly:

- If a CAD operator error occurred during CAD data base creation, the error shall be recorded in the incident log as such. All results and other data generated during the creation of this data base, including pre-processing, shall be disregarded. Testing shall resume with

Section 5.1 and continue with Sections 5.2 and 5.5;

- If a CAD operator error occurred during pre- or post-processing, the error shall be noted as such in the incident log. All results generated from processing shall be disregarded. Testing shall continue with Sections 5.1.8, 5.2, and 5.5 if pre-processing or Sections 5.3.1, 5.4, and 5.5 if post-processing;
- If it is an analyzer error and the entity was processed correctly according to the criteria presented in Section 5.4, the IGES entity type and/or the field value wrongly indicated by the analyzer and all analyzer messages generated in reference to the entity and/or field value in question shall be recorded in the incident log. The name and version number of the analyzer with its command line syntax and interactive responses entered by the CAD operator also shall be noted. The vendor of this IGES file analyzer software package shall be notified by the customer representatives concerning this discovery. The error shall not influence the evaluation of the CAD system;
- If it is due to CAD system or the IGES processor internally, testing shall resume with Section 5.5.2;
- If it is due to an error or an inappropriate limitation in MIL-D-28000 or the user-defined requirements, as perceived by the testing administrator and the CAD/IGES evaluators, this discovery shall be recorded in the incident log. This exception shall be allowed and the owner of that document shall be contacted concerning this deficiency.[4] All results shall be considered preliminary until this issue has been resolved. If it is later determined by the maintenance activity of that document the perceived error or limitation is permissible in the context of the document, the test results shall be modified to reflect this non-compliance by appending this to the incident log, according to Section 5.2 if it is in a

[4]Any perceived limitations or errors discovered in MIL-D-28000 shall be reported using DD Form 1426 - Standardization Document Improvement Proposal, the last page of MIL-D-28000.

pre-processing context or 5.3 if it is in a post-processing context, and continuing with the remainder of Section 5. If the perceived error or limitation is considered erroneous, according to the document's owner, the results are final.

5.5.2. The CAD/IGES evaluators shall determine if the system implements all exercised concepts in accordance with the selected class in MIL-D-28000 and the user-defined requirements, using the findings generated from the pre- and post-processor test segments including events recorded in the incident log and results compiled from Section 5.5.1. The decision shall be based on the following criteria specified from the most general to specific:

- adherence to the version of IGES specified by MIL-D-28000;
- the priority of the tested concepts according to the list generated prior to testing, as determined in Section 4.4;

Pre-processor only:

- ability to pre-process a CAD data base without aborting;
- ability to create CAD entities correctly representing the concepts, taking into account all deviations from the Data Base Description;
- syntactic and semantic accuracy of the IGES representation of the tested concepts compared against the appropriate values in the original CAD data base as indicated by the selected class in MIL-D-28000 and the user-defined requirements;
- correct generation of volunteer entities;

Post-processor only:

- ability to post-process an IGES file, compliant to the selected class in MIL-D-28000 and to the user-defined requirements, without aborting;
- ability to post-process an IGES file, compliant to the selected class in MIL-D-28000 and to the user-defined requirements, to achieve the levels of pictorial completeness and accuracy as well as functionality required of the CAD data base according to the selected class in MIL-D-28000, the user-defined requirements, the information represented in the IGES file, and the CAD system's software documentation.

5.5.3. If any inconsistencies in the CAD system or IGES processor were found and if possible according to the system's CAD/IGES entity mapping scheme, MIL-D-28000, and the user-defined requirements, the CAD operator shall propose an alternate CAD operator command(s) for each. Each alternate should be compliant to the selected class in MIL-D-28000 and the user-defined requirements, and should create, modify, or process a specific aspect of a CAD data base which the previously chosen method cannot accomplish due to a lack of compliance to the selected class in MIL-D-28000 or the user-defined requirements or due to limitations in the software. Each selected and approved alternate shall be recorded in the incident log as such with the need for pre-processor re-testing. The results from pre-processor evaluation shall be disregarded and testing shall resume with Section 5.1.5 applying these alternates. The results from post-processor evaluation shall be retained.

5.5.4. If any inconsistencies or non-compliances could not be resolved by implementing applicable alternate CAD operator commands, the CAD system shall not be considered compliant to the selected class in MIL-D-28000 and the user-defined requirements. The value of the non-implemented aspects of the CAD data base, the selected class in MIL-D-28000, and the user-defined requirements shall be determined by the customer representatives. If any required attributes of the selected application, according to reference [1] or the user-defined requirements, cannot be represented according to the criteria presented in Section 5.5.2, or if the processor aborts, then it may not be worth the time to spend continuing with application-specific testing of these processors. This decision shall be made by the customer representatives and approved in writing recorded in the incident log by the testing administrator.

5.5.5. Testing can continue with Section 5.1, applying other concepts, if so desired by the customer representatives and approved, in writing in the incident log, by the testing administrator.

5.6. The CAD/IGES evaluators and the testing administrator shall complete a Phase I test report, in the format specified by Appendix F, on the system's support of all designated

application concepts tested as specified by customer requirements and compliant with the selected class in MIL-D-28000 and the user-defined requirements. Digital media is preferred to provide easy replication of sections of the test report. The testing administrator shall determine the medium and software, if digital, and this shall be noted as an approval in the incident log. The report shall be released to the customer representatives upon completion. The findings generated from Phase I testing, including events recorded in the incident log and results compiled from Section 5.5, shall be subjected to the criteria specified in Section 5.5.2.

5.7. Testing shall continue with Section 6, Phase II Testing Scheme, if it has been determined to be worthwhile in Section 5.5.4 and as reflected in the test report generated in Section 5.6. This shall be decided by the customer representatives and approved, in writing in the incident log, by the testing administrator.

6. Phase II Testing Scheme

6.1. The scenario implemented in this phase is dependent on the application concepts stressed in the previous phase. This aspect of testing shall be addressed only if all concepts to be tested have been in Phase I and if the test results compiled show that the CAD system has potential in compliancy to the selected class in MIL-D-28000 and adherence to the user-defined requirements, according to the customer representatives and the testing administrator, as documented in Section 5.5.4.

The tasks in sections 6.2 thorough 7.6 shall be performed for the application scenario applicable to the customer's requirements as determined by the customer representatives in Sections 4.2 and 4.3.

6.2. Pre-processor testing shall be proceeded as follows:

6.2.1. The customer representatives shall obtain the proper test case, if available, based on the customer's requirements as determined in Sections 4.2 and 4.3. If an appropriate test case is not available, the customer representatives shall either consult reference [5] to create such a test case or proceed to test other application scenarios and return to the previously selected scenario later, with approval, in writing as recorded in the

incident log, by the testing administrator. Any test case developed shall be completed by a date designated by the customer representatives. All test cases shall be or have been developed and validated according to test case development and validation procedures presented in reference [5]. All new test cases developed shall be abstracted in reference [6] with the Purpose and a book-form plot.

6.2.2. The testing administrator shall review the test case to determine if it thoroughly meets the needs of the customer. If it does not, another test case shall be obtained. If an appropriate test case is not available, the customer representatives shall consult reference [5] to create such a test case, with written approval recorded in the incident log by the testing administrator.

6.2.3. The testing administrator shall thoroughly review the test case for all errors and inconsistencies. A test case is comprised of a Data Base Description, an IGES file, a plot(s) of the pictorial representation(s) of the data base as defined in the IGES file, and an Evaluation Script. The following criteria shall be considered during review, within the user-defined requirements and the requirements specified in MIL-D-28000 and reference [2] or [3]:

- the Data Base Description completely reflects the application scenario to be emphasized in this test case;
- the IGES file is in the correct ASCII format per reference [2] or [3];
- the IGES file completely and correctly reflects the Data Base Description;
- the IGES file thoroughly and correctly represents each application scenario under test and IGES entity usage per reference [2] or [3], the user-defined requirements, and MIL-D-28000;
- each plot correctly and completely pictorially reflects the data in the IGES file;
- the Evaluation Script thoroughly represents all required and typical properties of the application scenario emphasized in this test case, according to reference [5];
- the Evaluation Script is correctly and completely reflected in the IGES file.

If any technical errors were discovered with the test case, the testing administrator shall, with concurrence from the customer representatives, correct the test case and proceed with this section. The testing administrator also shall send the suggested modifications, with rational, on a DD Form 1426 to the CTN for evaluation. If the CTN found any technical errors with the suggested modifications which may effect the outcome of testing, the CTN shall notify the testing administrator. Testing shall be repeated, nullifying the previous test results, applying the approved test case.

If the only errors in the test case are grammatical and shall not technically affect the outcome of the testing, the testing administrator shall correct the test case and continue with this section. The testing administrator shall send the suggested modifications on a DD Form 1426 to the CTN who shall review it, as indicated in the previous paragraph.

6.2.4. The CAD operator shall append onto the list of successfully-used CAD operator commands, accumulated from prior testing with this test plan on this CAD system, additional commands creating or modifying geometry, structure, or annotation which are needed to represent the application scenario under test, according to MIL-D-28000, the user-defined requirements, and the analysis of customer's requirements. A mathematician may be consulted if the arithmetic complexity is beyond the scope of the operator's capabilities. If there is more than one method of creating or modifying a particular aspect of the CAD data base or if the construct is not supported by the CAD system, the selection of the most appropriate procedure shall depend on the following criteria, listed in order of precedence:

- most accurate representation of data in CAD data base and IGES, according to vendor documentation and CAD/IGES entity mapping scheme;
- most acceptable CAD/IGES mapping scheme according to MIL-D-28000 and the user-defined requirements.

The selected method shall be included in the compiled list of CAD operator commands. If the selection was due to an unsupported construct, it shall be noted as such in the incident log.

Each of these CAD operator commands shall produce or modify a CAD entity(s) mapping into an IGES entity(s), according to its CAD/IGES entity mapping scheme, if its contribution in representing product definition data in the IGES file is valid according to the selected class in MIL-D-28000 and the user-defined requirements.

6.2.5. The vendor representative shall review the modifications to this compiled listing if this pre-processor has not been tested for the support of this application scenario previously. If this pre-processor is being re-tested due to the discovery of non-compliance to the selected class in MIL-D-28000 or the user-defined requirements, the representative shall review the proposed alternate CAD operator commands. If the representative finds any objections to this list or to the alternate, he/she shall address them to the testing administrator. An approval of the commands shall be in writing recorded in the incident log. The testing administrator shall revise this list and re-submit it for review by the vendor representative before testing proceeds.

6.2.6. The CAD operator shall initiate an audit trail to record all user input entered via any input device, automatically if provided by the facilities or manually if not.

6.2.7. The CAD operator shall create the CAD data base according to the Data Base Description included in the test case. The CAD data base in generation shall be queried for the result of the previous CAD operator action after each creation or modification of a CAD entity, whether it be geometry, annotation, or structure, and shall be compared with the intended result noted in the Data Base Description pertaining to this modification or creation. This will insure that all CAD operator actions are correctly executed, according to the Data Base Description and the CAD system documentation, and that the CAD system interpreted these actions correctly. The data base in

generation shall also be copied to the disk, referenced by the file name assigned by the operator, every fifteen minutes. If a CAD operator error occurs which appeared to modify the data base, the data base shall be restored to its state prior to the unintended modification and then its construction be continued. This error also shall be recorded in the incident log. If the CAD system misinterpreted a CAD operator command, according to software documentation supplied by the vendor, the CAD operator shall note the following in the incident log:

- exact instruction entered by the CAD operator resulting in this misinterpretation
- the intended result of the entered command according to vendor documentation provided with the CAD system
- how the CAD system actually interpreted the entered command, including the results of the data base query
- the instruction entered to query the data base.

If the test cannot continue after such an error occurs, the CAD operator shall exit from the data base without saving any changes since the last save. The CAD operator shall document this action in the incident log and continue with Section 6.4.

The Data Base Description can be applied to any CAD system and do not intentionally reference any particular CAD system. If any aspect of the Data Base Description cannot be performed, due to lack of support by the CAD system, the CAD operator shall note the unsupported attributes as such in the incident log. All such incidents shall be considered during system evaluation.

6.2.8. The CAD operator shall save the CAD data base once completed so it can be pre-processed.

6.2.9. The CAD operator shall pre-process the CAD data base according to the instructions provided by the vendor representative. The CAD operator also shall instruct the processor to generate a file containing processing messages, referred to as a message log file, if this capability is provided.

The processor should not abort for any reason due

to information represented in the CAD data base. If it does abort, the CAD operator shall note this failure in the incident log including all messages found in the message log file and all processor messages generated for CAD operator notification. This incident shall be considered during system evaluation.

6.3. The accuracy and completeness of the IGES file shall be determined by the CAD/IGES evaluators, with assistance from a mathematician as needed, as follows:

6.3.1. The IGES file shall be examined for syntactic compliance to the selected class in MIL-D-28000 as well as reference [2] or [3]. Since the format of the Start Section is not defined in MIL-D-28000, it may have to be examined manually. All warning and error messages generated by the analyzer shall be recorded in the incident log.

6.3.2. It shall be determined if all CAD entities were pictorially processed correctly by visually comparing the graphical representation of the IGES file, provided by an IGES file analyzer tool, against the graphical representation of the CAD data base. Analyzing all messages generated during pre-processing shall also be performed to contribute to this evaluation.

6.3.3. All missing, displaced, and pictorially misprocessed entities shall be located in the IGES file using an IGES file analyzing tool providing entity evaluation. An entity is displaced if its location expressed in the IGES file is outside the required tolerance according to the selected class in MIL-D-28000 and the user-defined requirements. If any entities are found to be displaced or pictorially misrepresented, they shall be included in the IGES entity set for review, as designated by Section 6.3.4. If any entities are missing, the entity type and all commands which created or modified the missing entity shall be recorded in the incident log.

6.3.4. The IGES file shall be prepared for the evaluation of its data accuracy against the CAD data base. Since the size of such an IGES file can run into megabytes, it can be too burdensome to examine every IGES entity. Thus the following shall serve

as requirements for entity evaluation selection:

- one or more entities, depending upon time constraints, of each IGES entity type found in the IGES file, include entities of the same type with different form numbers;
- any entities which are reflected in several views;
- all curves, surfaces, conics, and other entities requiring complex calculations to evaluate their mathematical accuracy (for example IGES entities 104, 126, and 128);
- any entities reflecting concepts which were difficult to process during Phase I testing;
- any subfigure definitions and instances;
- all structural entities such as views;
- all entities which appear to be missing, misprocessed, or displaced in the overall visual review compiled in Sections 6.3.2 and 6.3.3.

6.3.5. The following attributes of each selected IGES entity shall be compared with its mapped CAD entity in the original data base, applying the user-defined requirements and those in MIL-D-28000 and reference [2] or [3]:

- support of the graphical representation of each CAD entity by the data structure of its mapped IGES entity(s);
- acceptance of the system-specified minimum resolution (Global field 19 in the IGES file) depending on the mathematical precision needs of the application represented and the smallest exponent applied during data base construction;
- accuracy of the coordinate data in each selected IGES entity according to the system-specified minimum resolution (Global field 19 in the IGES file) and its mapped CAD entity in the data base;
- mathematical precision of each IGES representation of curves, surfaces, and conics (for example IGES entities 104, 126, and 128) compared against its mapped CAD entity;
- accuracy of entity transformations, using IGES entity 124, compared with their representations in the CAD data base;
- accuracy of such entity attributes as font, color, weight, and level;

- retention of functionality of CAD entities in their IGES representations;
- correctness of entity mappings according to its CAD/IGES entity mapping scheme.

6.3.6. The CAD operator commands, which created or modified entities successfully mapping into entities in the selected class in MIL-D-28000 with appropriate Parameter and Directory Entry values, shall be noted under the COMMAND column in the APPLICABLE section of the entity usage log, according to Appendix E, if not previously been noted for the creation or modification of the same CAD entity during previous testing of this IGES processor. Each command shall be entered in the CREATE subsection if the command created the CAD entity or in the MODIFY subsection if it modified the entity. The names of the CAD entity types, whose entities were processed accurately according to the selected class in MIL-D-28000 and the user-defined requirements, shall be specified alongside each command in the ENTITIES column. These commands shall be used for testing other applications and for CAD user information.

6.3.7. The CAD operator commands, which created or modified entities which were not successfully processed into the expected IGES entities in the selected class with appropriate Parameter and Directory Entry values, shall be noted in the entity usage log in the NOT APPLICABLE section in the suitable subsection. If the command's intent, in this erroneous context, was to create a CAD entity, the command shall be entered in the CREATE subsection under the COMMAND column. If the intent is to modify a CAD entity, the command shall be entered in the MODIFY subsection under the COMMAND column. The reporting of such commands prevents their use in the same context in the future. If a command was APPLICABLE to certain entities but NOT APPLICABLE to others, separate entries shall be created for both APPLICABLE entities and NOT APPLICABLE entities. The commands which were misinterpreted by the CAD system, as recorded in the incident log, shall be included also. Each entity type, whose entities were not processed accurately according to the selected class in MIL-D-28000 and the user-defined requirements, shall be noted, in the manner stated in Section 6.3.6,

alongside its applicable command under the ENTITIES column.

6.3.8. All IGES entities which do not map to any CAD entities created by the CAD operator, according to its CAD/IGES entity mapping scheme, shall be noted and classified in the incident log as excessive entities or volunteer entities.

6.4. The CAD operator shall proceed with testing as follows:

6.4.1. The IGES file shall be loaded onto the hardware platform of the CAD system under test. If the processor or its operating system environment cannot accept the file, formatted in ASCII per reference [2] or [3], testing shall proceed to Section 7.

6.4.2. The IGES file, accompanying the test case, shall be post-processed according to the instructions provided by the vendor representative. A message log file shall be generated if the processor provides the option. All errors and warnings shall be recorded in the incident log.

6.4.3. The processor should not abort for any reason due to information represented in the IGES file. If it does abort, this failure shall be noted in the incident log, including all messages generated by the processor, and testing shall proceed to Section 7.

6.5. The CAD/IGES evaluators shall inspect the CAD data base for inconsistencies as follows:

6.5.1. The CAD data base shall be accessed to visually evaluate its graphical representation. If the data base requires any preparation before it can be pictorially depicted and accessible for modification, this preparation shall be performed and recorded in the incident log. The resulting graphic representation of the CAD data base shall be compared against the plot provided. The names of all CAD entities which are missing, displaced, or incorrectly processed, according to the graphical representation, shall be noted in the incident log. How the entity was misprocessed (e.g. missing, displaced, geometrically incorrect) shall also be noted.

6.5.2. The data base representation of the entities, described in the Evaluation Script, shall be compared against these descriptions in the following areas:

- acceptable CAD entity representation of mapped IGES entity(s) per the selected class in MIL-D-28000 and the user-defined requirements;
- acceptable coordinate location of the entities in the data base, within the minimum resolution specified in the IGES file (Global field 19), according to the user-defined requirements and the selected class in MIL-D-28000;
- acceptable entity attributes such as for line font, color, weight, and level according to user-defined requirements and the selected class in MIL-D-28000.

All examined entities which were not processed according to these criteria and the aspects in which they were processed inaccurately shall be noted in the incident log as such. The entity type of each misprocessed IGES entity, the DE number, and coordinate locations with their roles defining the placement of the entity (e.g. endpoint, center) shall be included. All entities from which such information could not be derived shall be noted in the incident log also. The command line syntax of the system-supplied entity query tool shall be recorded in the incident log as such.

6.5.3. The functionality of the entities noted in the Evaluation Script shall be evaluated. The manipulation of these entities shall include the following operations in different view environments if the CAD system possesses these capabilities according to system documentation provided by the vendor representative, for example:

- creating and deleting entities;
- moving entities (on same level, to different levels, to different Z planes);
- editing entities (changing endpoints, trimming, deleting, exploding--subfigures only);
- modifying characteristics (font, height, weight, color, size);
- analyzing the effects of these actions on other entities independent of or dependent on this subjected entity.

All operations which were not successfully completed, but should have been according to the claimed capability of this CAD system, shall be recorded in the incident log. The name of the CAD entity, on which the unsuccessful operation was performed, and its location shall be noted also.

6.5.4. Control shall be returned to the operating system environment without saving any modifications to the CAD data base.

7. Compliancy Resolution

7.1. The cause for each error or warning message generated from the IGES file analyzers and each error and limitation discovered during manual review, documented in Sections 6.2 through 6.5, shall be determined, by the CAD/IGES evaluators with assistance from a mathematician when needed, as one of the following instances and shall be resolved accordingly:

- If a CAD operator error occurred during CAD data base creation, the error shall be recorded in the incident log as such. All results and other data generated during the creation of this data base, including pre-processing, shall be disregarded. Testing shall resume with Section 6.2 and continue with Sections 6.3 and 7.1;
- If a CAD operator error occurred during pre- or post-processing, the error shall be noted as such in the incident log. All results generated from processing shall be disregarded. Testing shall resume with Section 6.2.8 if pre-processing or Section 6.4.1 if post-processing;
- If it is an analyzer error and the entity was processed correctly according to the criteria presented in Section 6.5, the IGES entity type and/or the field value wrongly indicated by the analyzer and all analyzer messages generated in reference to the entity and/or field value in question shall be recorded in the incident log. The name and version number of the analyzer with its command line syntax and interactive responses entered by the CAD operator shall also be noted. The vendor of this IGES file analyzer software package shall be notified by the customer representatives concerning this discovery. The error shall not influence in the evaluation of the CAD system;

- If it is due to CAD system or the IGES processor internally, testing shall resume with Section 7.2;
- If it is due to an error or an inappropriate limitation in MIL-D-28000 or the user-defined requirements, as perceived by the testing administrator and the CAD/IGES evaluators, this discovery shall be recorded in the incident log. This exception shall be allowed and the maintenance activity of that document shall be contacted concerning this deficiency.[5] All results shall be considered preliminary until this issue has been resolved. If it is later determined by the owner the perceived error or limitation is permissible in the context of the document, the test results shall be modified to reflect this non-compliance by appending this to the incident log, according to Section 6.3, if it is in a pre-processing context, or 6.4, if it is in a post-processing context, and continuing with the remainder of Section 7. If the perceived error or limitation is erroneous, according to the document's owner, the results are final.

7.2. Any deviations from the following criteria, applied to pre-processing a CAD data base, results in a non-compliant IGES pre-processor:

- ability to pre-process a CAD data base without aborting;
- ability to create CAD data base to be processable into an IGES file compliant to the selected class in MIL-D-28000 and the user-defined requirements;
- correct generation of volunteer entities;
- completeness and correctness of the IGES file in depicting all graphic and functional aspects of the CAD data base as indicated by the selected class in MIL-D-28000 and the user-defined requirements.

If possible according to the system's CAD/IGES entity mapping scheme, MIL-D-28000, and the user-defined requirements, the CAD operator shall propose an alternate CAD operator command(s) for each. Each alternate should be compliant to the selected class in MIL-D-28000 and to the user-defined requirements, and should create, modify, or process a specific aspect of a CAD data base which the

[5]Any perceived limitations or errors discovered in MIL-D-28000 shall be reported using DD Form 1426 - Standardization Document Improvement Proposal, the last page of MIL-D-28000.

previously chosen method cannot accomplish due to a lack of compliance to the selected class in MIL-D-28000 or the user-defined requirements, or to limitations in the software.

Each selected and approved alternate shall be recorded in the incident log as such and the need for pre-processor entity re-testing. The results from pre-processor evaluation shall be disregarded and testing shall resume with Section 6.2.5 applying the alternate. The results from post-processor evaluation shall be retained if they are valid according to this test plan.

7.3. If any inconsistencies could not be resolved by implementing applicable alternate CAD operator commands, the CAD system shall not be considered compliant to the selected class in MIL-D-28000 and to the user-defined requirements. The value of the non-implemented aspects of the CAD data base, the selected class in MIL-D-28000, and the user-defined requirements shall be determined by the customer representatives. If any required attributes of the selected application scenario, according to reference [1] or the user-defined requirements, cannot be represented according to the criteria presented in Section 7.2, or if the processor aborts, then the CAD system shall not be used to create or process IGES files which are or should be compliant to the selected class in MIL-D-28000 nor to create CAD data bases which are planned to be applied in generating an IGES file compliant to the selected class.

7.4. Any post-processor which does not meet the following criteria shall disqualify the CAD system as being a tool to support applications compliant to the selected class in MIL-D-28000:

- ability to post-process an IGES file, compliant to the selected class in MIL-D-28000 and the user-defined requirements, without aborting;
- ability to post-process an IGES file, compliant to the selected class in MIL-D-28000 and the user-defined requirements, to achieve the levels of pictorial completeness and accuracy as well as functionality required of the CAD data base according to the selected class in MIL-D-28000, the user-defined requirements, the information represented in the IGES file, and the CAD system's software documentation;
- ability to post-process an IGES file, compliant to the selected class in MIL-D-28000 and the user-defined requirements, to achieve the level of functionality

required of the CAD data base according to the selected class in MIL-D-28000, the user-defined requirements, the information represented in the IGES file, and the CAD system's software documentation.

A compliant post-processor shall be able to receive and process **any** IGES file compliant to the selected class in MIL-D-28000 and the user-defined requirements into a CAD data base complying to the selected class in MIL-D-28000 and the user-defined requirements.

7.5. The CAD/IGES evaluators and the testing administrator shall complete an application test report, in the format specified by Appendix F, on the system's support of the designated application scenario as specified by customer requirements and compliant with the selected class in MIL-D-28000 and the user-defined requirements. Digital media is preferred to provide easy replication of sections of the test report. The testing administrator shall determine the medium and software, if digital, and this shall be noted as an approval in the incident log. The report shall be released to the customer representatives upon completion. The findings generated from Phase II testing, including events recorded in the incident log and results compiled from Sections 7.1 through 7.4, shall be subjected to the criteria specified in Sections 7.2 and 7.4.

7.6. Testing may continue applying other application scenarios if the results thus far demonstrates compliancy to the selected class in MIL-D-28000 and the user-defined requirements, as determined from the analysis designated in Sections 7.3 through 7.5. If the results do not show compliancy, further testing may be suspended.

8. CAD User Information

8.1. Procedures for creating and pre-processing CAD data bases and post-processing compliant IGES files on this CAD system, qualified through this test plan, shall be compiled and delivered by the testing administrator to the customer representatives. They shall distribute this information to users of this CAD system, employed or contracted by the customer, who shall be required to apply the user-defined requirements and the selected class in MIL-D-28000 when creating, modifying, or processing CAD data bases. The information provided shall be comprised of the following:

- CAD operator commands to create/modify specific

entities including any particularities;
- all rules for pre-processing the data base, including the selection of options;
- all rules for post-processing a compliant IGES file, including all commands to be performed when entering the CAD data base to be correctly pictorially depicted and accessible for modification by the user;
- each CAD operator command selected, coupled with its functional intent during testing, which was determined to be non-compliant to avoid its use in the same context and shall be designated as such;
- correct CAD/IGES entity mapping scheme;
- all user-defined requirements applicable to the CAD user which are not reflected in other information provided to the user.

APPENDIX A: REFERENCES

[1] Digital Representation for Communication of Product Data: IGES Application Subsets and IGES Application Protocols, Military Specification MIL-D-28000, Revision A, Amendment 1, December 14, 1992.

[2] Digital Representation for Communication of Product Definition Data, ASME Y14.26M, 1989.

[3] Initial Graphics Exchange Specification (IGES), Version 5.1, Reed, K., Kelly, J., Harrod, D., and Conroy, W., September 1991.

[4] Initial Graphics Exchange Specification (IGES), Version 5.0, Reed, K., Harrod, D., and Conroy, W., NISTIR 4412, September 1988.

[5] Test Case Development and Verification Guide for MIL-D-28000, Version 1.0, CALS Test Network, CTN Report 93-017, March 19, 1993.

[6] MIL-D-28000 Test Case Index and Abstracts, Version 1.0, CALS Test Network, CTN Report 93-018, March 19, 1993.

Copies of reference [1] are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Ave., Philadelphia, PA 19111-5094.

Copies of reference [2] are available from The American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.

Copies of reference [3] and [4] are available from the National Computer Graphics Association, 2722 Merrilee Dr., Suite 200, Fairfax, VA 22031, ATTN: IPO Administrator.

Copies of references [5] and [6] are available from the CALS Test Network Office which may be contacted at (513) 257-3085 or lammers@logdis1.hq.aflc.af.mil.

APPENDIX B: GLOSSARY

class - specifies a particular CAD/CAM application addressed in the realm of product definition data exchange by MIL-D-28000.

computer-aided design (CAD) - attributing the function of design to an aspect by means of a computer in which its data generated is digitally stored in a data base accessible to the design software.

CAD data base - the CAD system's internal digital representation of user-defined product definition data in a pre-defined structure.

CAD entity - an individual element, whose structure is defined by the CAD system, specified by a CAD operator for inclusion in a CAD data base and accessible for modification.

CAD operator command - information issued to the CAD system by the CAD operator in which the intent is to create, modify, or query one or more aspects of a CAD data base.

CAD system - software which provides a person with the capability to design and modify engineering drawings, electrical/electronic products, or other application byproducts, stored in a digital format in a data base.

Data Base Description - a document, provided with the test case, comprising of the specification of the contents of the CAD data base to be created for pre-processing into IGES.

entity usage log - a CAD system-specific hard-copy log, which is generated by the CAD/IGES evaluators, documenting which CAD operator commands can be used to create or modify certain aspect(s) of the CAD data base and those commands which do not perform or process as expected according to CAD system documentation and the CAD/IGES entity mapping scheme

Evaluation Script - a script, which is a part of the test case, presenting the aspects to be examined in the CAD data base generated from a post-processed IGES file

excessive entities - entities found in an IGES file which are not volunteer entities and do not represent any aspect of the originating CAD data base

functionality - characteristics of a CAD data base which are exclusive of the purely pictorial, graphic realm

graphical representation - how an entity is pictorially depicted to the human eye

incident log - a CAD system-specific, manually-generated log where any incidents occurring during testing or evaluation, as noted in the test plan, are recorded by those involved in the testing

Initial Graphics Exchange Specification (IGES) - a specification establishing information structures to be used for the digital representation and communication of product definition data, permitting the compatible exchange of these data used by various CAD/CAM systems.

IGES file analyzer tools - software which evaluates an IGES file against IGES and/or additional criteria, such as those specified in MIL-D-28000

message log file - a log file, automatically generated by the CAD system, which records all CAD operator interactions with the system

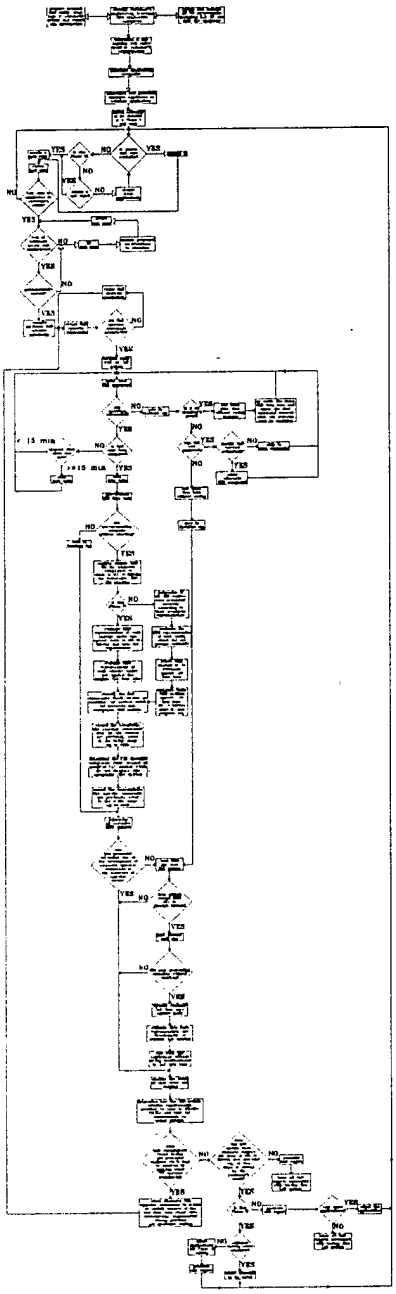
post-processor - software residing on a CAD system which receives an IGES file and interprets the data in that file, according to its CAD/IGES entity mapping scheme and its internal processing, to generate an equivalent CAD data base

pre-processor - software residing on a CAD system which receives a CAD data base, generated on that system, and creates an IGES file incorporating the data present in the CAD data base depending upon its CAD/IGES entity mapping scheme and its internal processing

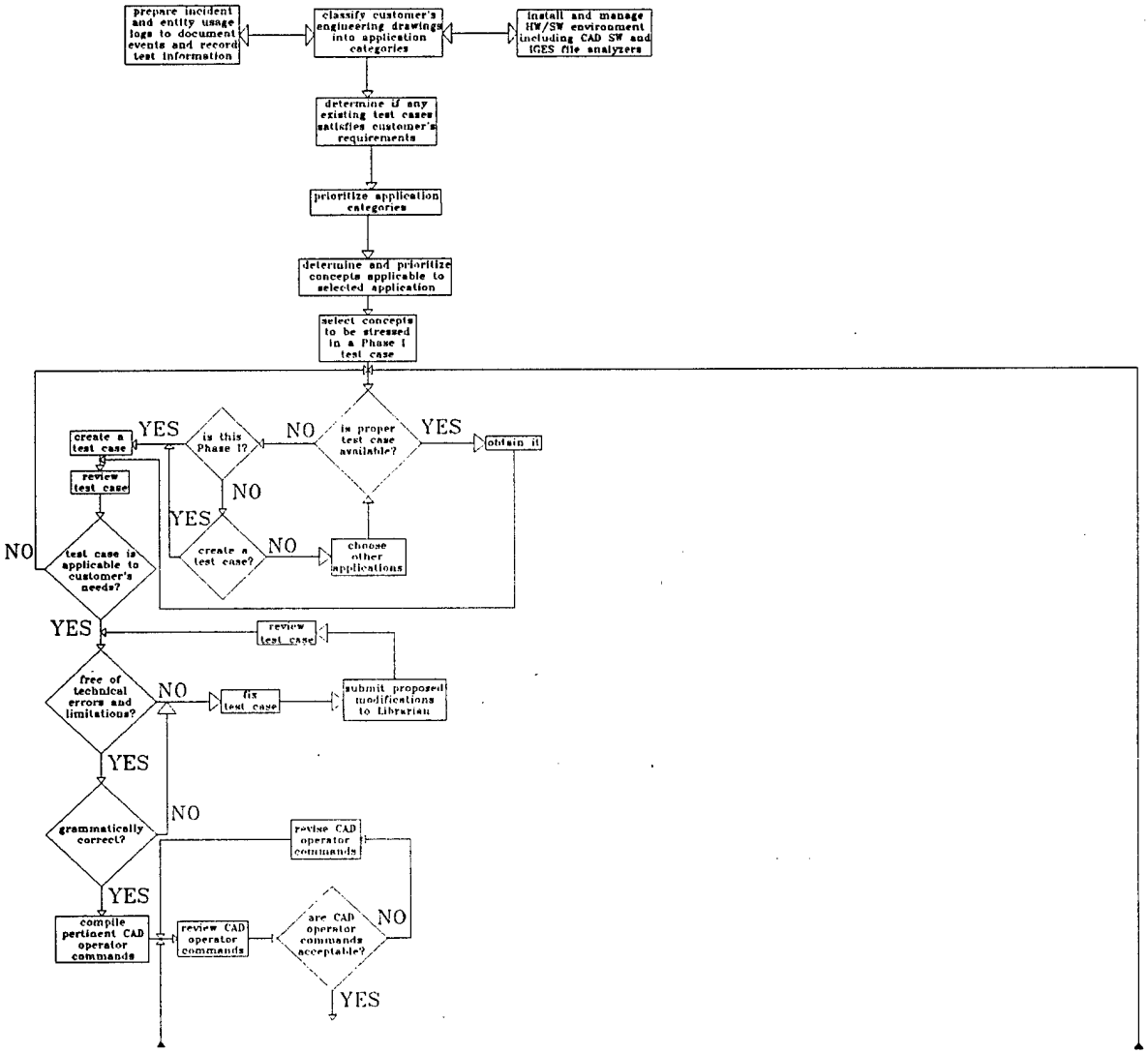
product definition data - those data, regardless of form, which determine the essential characteristics of a product in its final or completed state

volunteer entity - a valid IGES entity, present in an IGES file, which is not necessary to the product definition data representation and exists solely for the purpose of regenerating the same development environment when the file is transferred back to the same CAD system which originally generated the file and may be ignored by other CAD systems

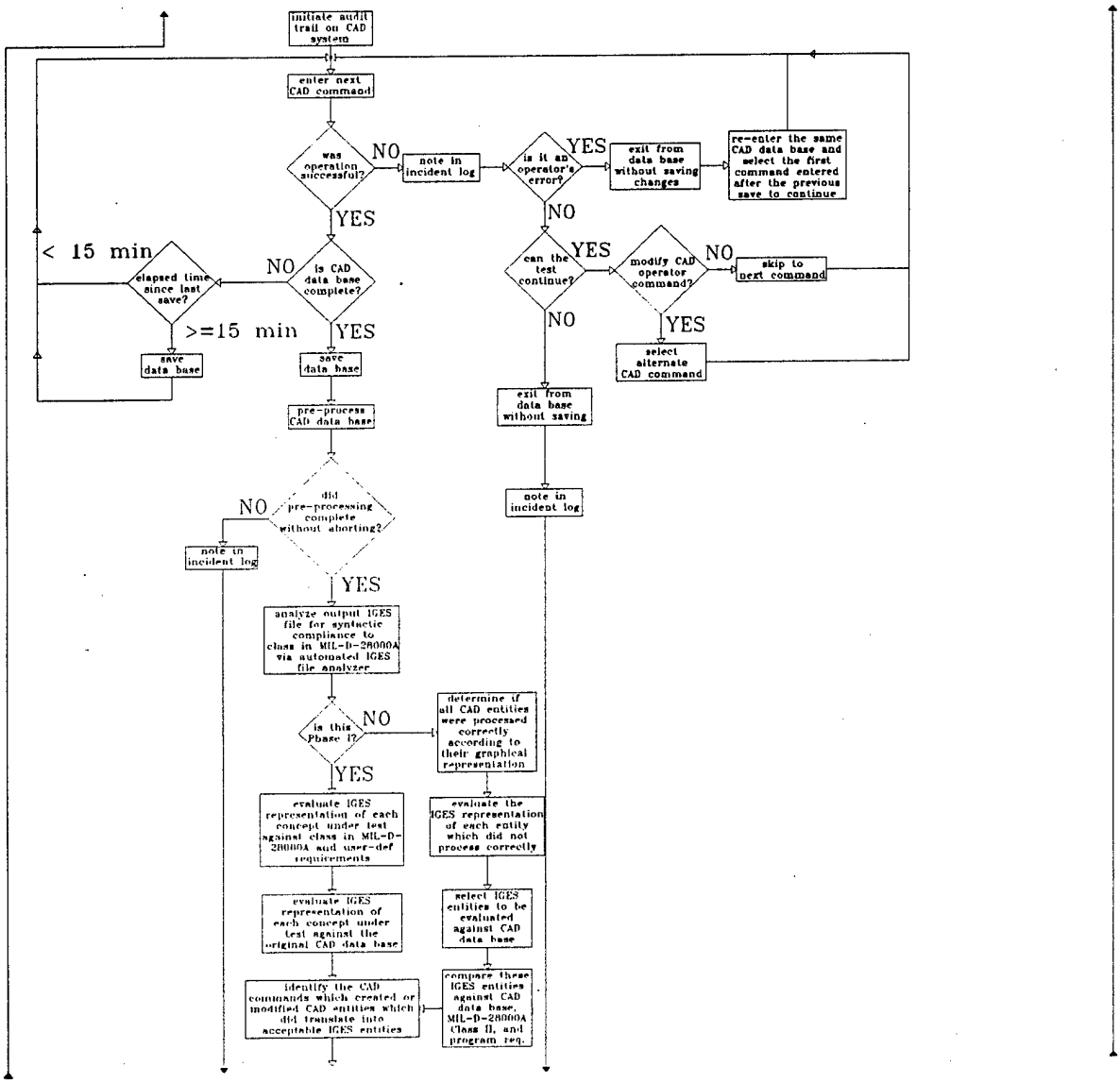
APPENDIX C: TESTING PROCESS FLOW CHART



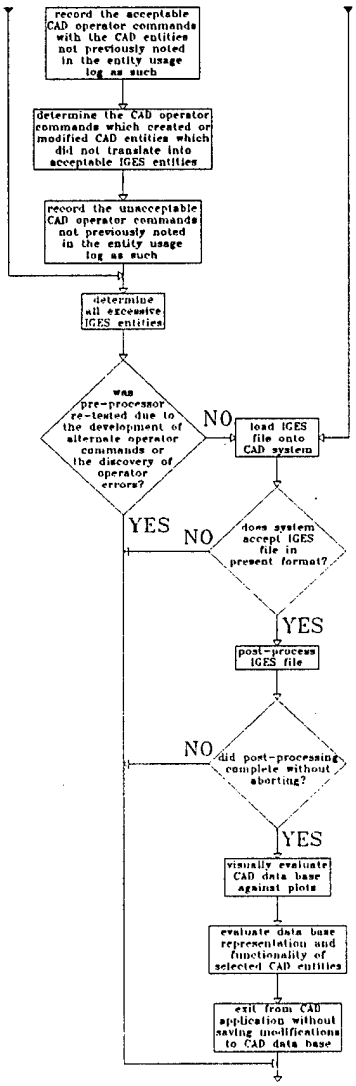
Complete Flow Chart


prepare incident and entity usage logs to document events and record test information
classify customer's engineering drawings into application categories
install and manage HW/SW environment including CAD SW and IGES file analyzers
determine if any existing test cases satisfies customer's requirements
prioritize application categories
determine and prioritize concepts applicable to selected application
select concepts to be stressed in a Phase I test case
create a test case
YES
is this Phase I?
NO
is proper test case available?
YES
obtain it
review test case
NO
YES
create a test case?
NO
choose other applications
NO
test case is applicable to customer's needs?
YES
review test case
free of technical errors and limitations?
NO
fix test case
submit proposed modifications to Librarian
YES
grammatically correct?
NO
revise CAD operator commands
YES
compile pertinent CAD operator commands
review CAD operator commands
are CAD operator commands acceptable?
NO
YES

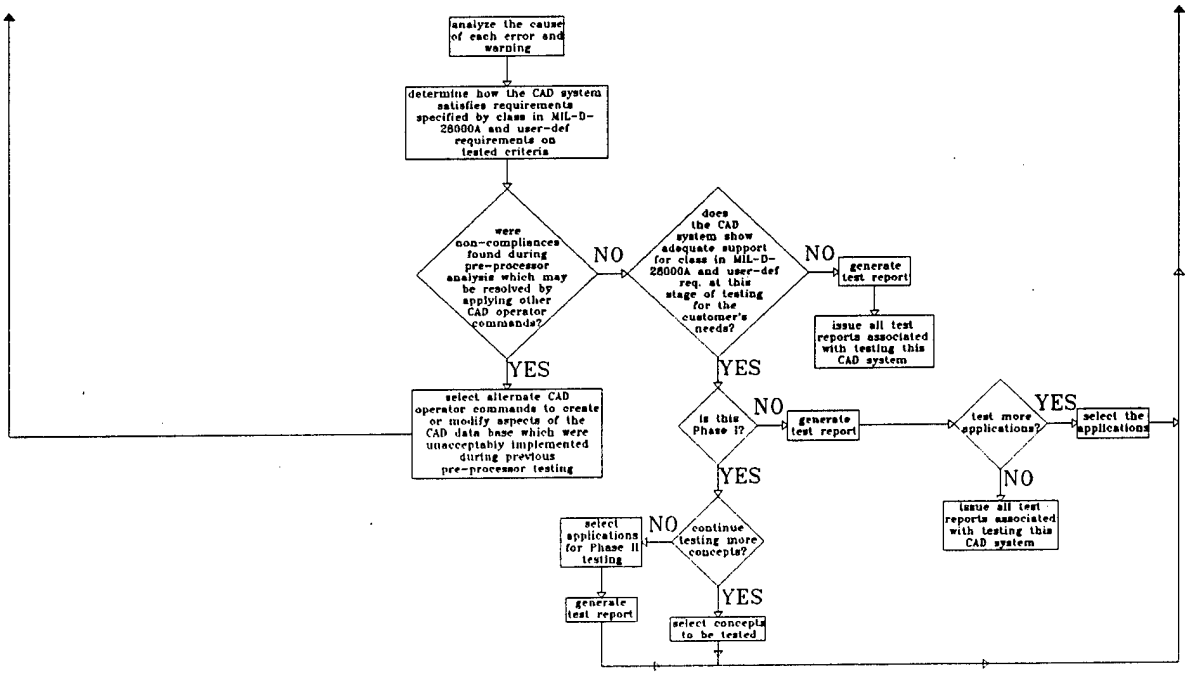
Detail A


initiate audit trail on CAD system
enter next CAD command
was operation successful?
NO
note in incident log
is it an operator's error?
YES
exit from data base without saving changes
re-enter the same CAD data base and select the first command entered after the previous save to continue
YES
NO
< 15 min
elapsed time since last save?
NO
is CAD data base complete?
can the test continue?
YES
modify CAD operator command?
NO
skip to next command
>=15 min
YES
NO
YES
save data base
save data base
select alternate CAD command
pre-process CAD data base
exit from data base without saving
did pre-processing complete without aborting?
NO
note in incident log
note in incident log
YES
analyze output IGES file for syntactic compliance to class in MIL-D-28000A via automated IGES file analyzer
is this Phase I?
NO
determine if all CAD entities were processed correctly according to their graphical representation
YES
evaluate IGES representation of each concept under test against class in MIL-D-28000A and user-def requirements
evaluate the IGES representation of each entity which did not process correctly
evaluate IGES representation of each concept under test against the original CAD data base
select IGES entities to be evaluated against CAD data base
identify the CAD commands which created or modified CAD entities which did translate into acceptable IGES entities
compare these IGES entities against CAD data base, MIL-D-28000A Class II, and program req.

Detail B


record the acceptable CAD operator commands with the CAD entities not previously noted in the entity usage log as such
determine the CAD operator commands which created or modified CAD entities which did not translate into acceptable IGES entities
record the unacceptable CAD operator commands not previously noted in the entity usage log as such
determine all excessive IGES entities
was pre-processor re-tested due to the development of alternate operator commands or the discovery of operator errors?
NO
load IGES file onto CAD system
YES
NO
does system accept IGES file in present format?
YES
post-process IGES file
NO
did post-processing complete without aborting?
YES
visually evaluate CAD data base against plots
evaluate data base representation and functionality of selected CAD entities
exit from CAD application without saving modifications to CAD data base

Detail C


analyze the cause of each error and warning
determine how the CAD system satisfies requirements specified by class in MIL-D-28000A and user-def requirements on tested criteria
were non-compliances found during pre-processor analysis which may be resolved by applying other CAD operator commands?
NO
YES
does the CAD system show adequate support for class in MIL-D-28000A and user-def req. at this stage of testing for the customer's needs?
NO
generate test report
issue all test reports associated with testing this CAD system
YES
select alternate CAD operator commands to create or modify aspects of the CAD data base which were unacceptably implemented during previous pre-processor testing
Is this Phase I?
NO
generate test report
test more applications?
YES
select the applications
NO
issue all test reports associated with testing this CAD system
YES
continue testing more concepts?
NO
select applications for Phase II testing
generate test report
YES
select concepts to be tested

Detail D

APPENDIX D: FORMAT OF THE INCIDENT LOG

1. Media Identification
The incident log shall be a loose-leaf notebook or a digital text file depending on the preference by the testing administrator. The log shall be noted on the cover or the first digital page, depending upon the media used, with the following information:

- name and version of the CAD system which processors are under test;
- version of IGES to which the processors claim compliance;
- name of the customer;
- name of the customer representatives accompanied by their phone numbers;
- location of the testing;
- dates of testing.

2. Testing Identification
The beginning of every test shall be noted with this information on a fresh page in the incident log:

- Phase of testing;
- criteria to which the processors are being tested, i.e., the selected class of MIL-D-28000 and user-defined requirements;
- concepts or application scenario under test.

3. Incident Indication Format
Each incident indication shall be followed by one or two blank lines for clarity. All incidents recorded shall be preceded by a date/time stamp at the time that function occurred, discovered, or generated, depending upon the function. Each item of an incident shall be noted as to contain its context in the individual incident report.

3.1. Approvals - Various decisions made require approvals from authorized testing personnel. Each approval is required to be recorded in the incident log in the following format:

date/time: "APPROVAL"
- name of the object being approved
- if applicable, the object's function relative to the approval
- purpose for the approval
- the individual's name who approved the object and his/her role in this testing.

3.2. Error or Warning Messages - All error and warning messages

shall be noted in their entirety, including other messages as noted. The person who discovered the error shall determine whether it is an error or warning if the message does not explicitly designate it as such. If it cannot be determined, the message shall be classified as an "ERROR." If one message is generated more than two times, indicate the number of times it appears with all differences between each instance noted.

The format is as follows:

date/time: "WARNING" or "ERROR"
- name of software;
- process occurring, from the viewpoint of the person who initiated the processing, which generated the message;
- warning/error message in entirety;
- additional event dependent information to be recorded, as noted in this test plan;
- number of times the identical or similar message was generated, if it occurred more than once;
- aspect in which each message differed, if the message was generated more than once;
- the value of the aspect in each message;
- name of individual discovering message and his/her role in testing, as defined in Section 3 of the main body.

3.3. Discoveries of CAD System Non-compliance, Inadequacy, and Misinterpretation - This includes such events as the following:

- incorrect processing of a CAD or IGES entity;
- misinterpretation of a CAD operator command by a CAD system;
- lack of support from the CAD system to create or modify a particular aspect;
- abortion of the IGES processor;
- discovery of aspects of the software hindering compliance to reference [2], the user-defined requirements, or the selected class in MIL-D-28000;
- generation of excessive IGES entities.

The format is as follows:

date/time: "CAD SW CONCERN"
- nature of the event which occurred;
- event-specific information, including the stage

of testing (refer to description of generic event in main body to determine which information shall be recorded);
- name of individual discovering event and his/her role in testing, as defined in Section 3 of the main body.

3.4. Discovery of IGES Analyzer Software Bugs - The format for the entry in the incident log of the discovery of an IGES file analyzer bug is the following:

date/time: "IGES FILE ANALYZER BUG"
- IGES entity and form numbers;
- line number(s) in the Directory Entry and/or Parameter Section, designated as such, where the error or warning was indicated to be;
- complete error or warning message in question generated by this IGES file analyzer software;
- complete command line syntax and interactive responses entered by the CAD operator;
- name and version number of this software;
- vendor of this software.

3.5. Alternate CAD Operator Commands - Alternate CAD operator commands, proposed by the CAD operator to satisfy inconsistencies, non-compliances, or limitations found in the CAD system or IGES processors, shall be recorded in the incident log in the following format:

date/time: "ALTERNATE CAD OPERATOR COMMAND"
- the alternate CAD operator command chosen;
- the previously chosen CAD operator command or constructs which the alternate is satisfying;
- the function of the alternate, including implications of its use of attempting to satisfy a request;
- where the alternate shall be applied, during data base creation, pre-processing, and/or post-processing.

3.6. CAD Operator Errors - Events of incorrect command or data entries, performed by the CAD operator, shall be documented in the incident log in the following format:

date/time: "CAD OPERATOR ERROR"
- the command line or data actually entered;
- the intended, correct command line or data input;
- the intended function to be performed;

- the effect the erroneous input had on any files generated or modified, including the CAD data base if applicable.

3.7. Limitations in MIL-D-28000 or the user-defined requirements - An error or inappropriate limitation discovered in either of these documents warrants an entry in the incident log. The format is as follows:

date/time: "MIL-D-28000 LIMITATION" or "USER-DEF REQ LIMITATION"
- the version and release date of the document;
- the section and/or page numbers where this potential limitation occurs;
- the actual quote of the potentially erroneous text;
- reason why this portion is considered erroneous and in what context;
- a proposed resolution for this potential limitation.

3.8. Preparation to view or modify CAD data base - The format to be applied when documenting, in the incident log, the preparation of a CAD data base, after post-processing, to be able to view or modify it is the following:

date/time: "CAD DATA BASE PREPARATION"
- each CAD operator command executed to assist in the preparation of the data base, including all erroneous commands to be documented as such according to Section 3.6 of this Appendix, paired with the functional intent of each.

3.9. Syntax for CAD data base query - The format to be applied to document the command line syntax used to query an aspect of the data base is the following:

date/time: "DATA BASE QUERY SYNTAX"
- command line syntax;
- aspect in which the syntax is used if it is limited.

APPENDIX E: INFORMATION ON ENTITY USAGE LOG

1. Overview

The entity usage log provides a means of recording the applicability of CAD operator commands to create or modify CAD entities correctly mapping into the appropriate IGES entities according to the selected class in MIL-D-28000 and the user-defined requirements. The utilization of these commands during testing shall be according to CAD system documentation. A CAD operator command used in a way other than what is specified in the documentation shall be considered an operator error and shall be handled in that manner.

2. Preparation

The entity usage log shall be a loose-leaf notebook or a digital text file depending on the preference by the testing administrator. The log shall be noted on the cover or on the first digital page, depending upon the media of the log, with the following information:

- name and version of the CAD system which processors are under test;
- version of IGES to which the processors claim compliance;
- concepts or application scenario under test;
- criteria to which the processors are being tested, i.e., the selected class of MIL-D-28000 and user-defined requirements;
- name of the customer;
- name of the testing administrator accompanied by his/her phone number.

This log, once completed, shall be a major contribution as compiled CAD user information as noted in Section 8.1 of the main body of this document.

3. Structure and Format

The log shall consist of two sections, "APPLICABLE" and "NOT APPLICABLE", separating the desirable CAD operator commands from the undesirable in context. Each section consists of two subsections, "CREATE" and "MODIFY", as rows designating the commands which create entities and those which modify or delete them. The format of each subsection shall be composed of two columns, one to record the CAD operator command used, "COMMAND", and the other to specify the CAD entities which were created or modified by that command, "ENTITIES".

4. Instructions on Completing Entity Usage Log

When specified in this test plan, a CAD operator command shall be

entered under the COMMAND column of the CREATE or MODIFY subsections of the APPLICABLE or NOT APPLICABLE sections. On the same line, or immediately succeeding lines if needed, the name of the applicable CAD entity will be entered. Two or three lines shall be skipped between entries of CAD operator commands, if the media of the log is paper-based, to permit room for additional entries of CAD entities for that command. If the media is digital, additional room should be automatically allocated when needed.

APPENDIX F: TEST REPORT FORMAT

1. General Information A test report shall be generated by the CAD/IGES evaluators and the testing administrator when stated in this document, according to this specified format.

Text enclosed between braces, {}, in Section 2, Template, are notes for those who are compiling the report. All quotation marks inside of the braces indicate terms which shall be indicated in the test report if applicable in context.

2. Template

{Certain sections of this template may be replicated in the test report, for example those which provide the documentation of errors discovered, to satisfactorily record the incidents occurred during testing.}

I. Overview of System Environment

Name of CAD System: _____

Version of Software: _____

Version of IGES to which the translators adhere: _____

Vendor: _____

Hardware Platform: _____

Operating System Environment Including Version: _____

_____

Supplemental CAD Software Package Name: _____

_____

Version: _____

Function: _____

_____

Date(s) entire CAD system was installed on hardware platform

and by whom: _____

_____

Names of test report preparers: _____

II. Introduction to Testing Environment

Name of IGES File Analyzer Software: _____

Version of Software: _____

Vendor: _____

Function of Software (choice of Validation and/or Presentation):

Criteria Software Tests To: _____

III. Staff and Dates

Date Application Testing Began: _____

Date Application Testing Ended: _____

The following are personnel participating in this testing, each accompanied by a phone number and an address at which he/she may be contacted:

CAD Operator: _____

Customer Representatives: _____

CAD System Administrator: _____

_____

_____

Testing Administrator: _____

_____

_____

CAD/IGES Evaluators: _____

_____

_____

_____

_____

_____

Vendor Representative: _____

_____

_____

IV. Test Case Information

Phase of testing (I or II): ____

Compliance testing criteria: _____

_____

Name of concepts/application scenario under test: _____

_____

Name of test case used for this application:

_____

All errors, inconsistencies, and limitations found in the test case after review as follows:

Error discovered: _____

_____

_____

_____

Deficiency created by error: _____

_____

_____

_____

Proposed resolution: _____

_____

_____

_____

CALS Test Network notified? _____

V. Pre-Processor Results

A. Data Base Creation

Each aspect of Data Base Description, provided with the test case, which could not be replicated in the CAD data base is as follows:

Aspect: _____

Reason for non-existence in data base: _____

_____

{The reason may be one of the following as applicable:
"- not supported by CAD system"
"- not translatable to MIL-D-28000 criteria"
"- not translatable to user-defined requirements"}

B. Command Line Syntax

The command line syntax used to pre-process the CAD file is: _____

Did processor abort before completely generating IGES file? _____

Processor-generated error/warning message: _____

_____

_____

C. IGES File Analysis

Each aspect of the generated IGES file which has been found not to accurately reflect the CAD data base, the selected class of MIL-D-28000, or to the user-defined requirements is documented as follows:

Aspect: _____

Document(s) and/or data base which this aspect does not adhere to: _____

In what manner is this aspect non-compliant to the specified document(s) and/or data base? _____

_____

VI. Post-Processor Results

A. Command Line Syntax

The command line syntax used to post-process the IGES file is: _____

_____

Did processor abort before completely generating CAD data base? _____

Processor-generated error/warning message: _____

_____

_____

B. CAD Data Base Analysis

Each aspect of the generated CAD data base which has been

found not to accurately reflect the IGES file, the selected class of MIL-D-28000, or the user-defined requirements, in the context presented in the IGES file, is documented as follows:

Aspect: _____

_____

_____

The document(s) and/or IGES file which this aspect does not adhere to: _____

_____

In what manner, including IGES entity type, DE and/or PD line number, and field number if applicable, is this aspect non-compliant? _____

_____

_____

_____

VII. Attachments

{A photo copy or print-out of sections of the incident log and entity usage log, pertaining to this application, shall accompany the test report.}

APPENDIX G: EXAMPLE TEST REPORT

{Note: The software, individuals and organizations mentioned in this appendix are fictional. However, the test case is real and is abstracted in reference [6]}

I. Overview of System Environment

Name of CAD System: DoeCADD

Version of Software: 2.0

Version of IGES to which the translators adhere: ASME Y14.26M 1989

Vendor: DoeSystems

Hardware Platform: DoeSTATION

Operating System Environment Including Version: DoeOS, version 3.2

Supplemental CAD Software Package Name: N/A

Version:

Function:

Date(s) entire CAD system was installed on hardware platform and by whom: February 19, 1993 by Terry Millsaps

Test report preparers GiGi Arnone and Amand Fried

II. Introduction to Testing Environment

Name of IGES File Analyzer Software: IGESEval's IGESCHK and IGESLook

Version of Software: 2.0 (IGESCHK) and 1.1 (IGESLook)

Vendor: IGESEval

Function of Software (choice of Validation and/or Presentation):

validation (IGESCHK), presentation (IGESLook)

Criteria Software Tests To: MIL-D-28000A (10 Feb 92)

III. Staff and Dates

Date Application Testing Began: 2/8/93

Date Application Testing Ended: 2/9/93

The following are personnel participating in this testing, each accompanied by a phone number and an address at which he/she may be contacted:

CAD Operator: Beverly Kalstein, 202/555-2321, Marzell, Kalstein, & Assoc., MS BW, 1519 17th St., NW, Washington, DC, 20019

Customer Representatives: Jeannie Marzell, 202/555-2321, Marzell, Kalstein, & Assoc., MS BW, 1519 17th St., NW, Washington, DC 20019

CAD System Administrator: Terry Millsaps, 202/555-2322, Marzell, Kalstein, & Assoc., MS BM, 1519 17th St., NW, Washington, DC, 20019

Testing Administrator: GiGi Arnone, 202/555-2322, Marzell, Kalstein, & Assoc., MS BM, 1519 17th St., NW,

Washington, DC 20019

CAD/IGES Evaluators: Amand Fried, 202/555-2330, Marzell, Kalstein, & Assoc., MS LM, 1519 17th St., NW, Washington, DC 20019

Vendor Representative: Mitzi Blattstein, 202/555-8466 DoeSystems, 629 New York Ave., NW, Washington, DC 20005

IV. Test Case Information

Phase of testing (I or II): I

Compliance testing criteria: Classes II & IV of MIL-D-28000A Amendment 1 (14 Dec 92) and "PRODUCT DATA EXCHANGE REQUIREMENTS FOR MARZELL, KALSTEIN AND ASSOCIATES"

Name of concepts/application scenario under test: View/Drawing/Model relationships; layering; visualization techniques

Name of test case used for this application:

"PYRAMID" TEST CASE

All errors, inconsistencies, and limitations found in the test case after review as follows:

Error discovered: NONE

Deficiency created by error: N/A

Proposed resolution: N/A

CALS Test Network notified?

V. Pre-Processor Results

A. Data Base Creation

Each aspect of Data Base Description, provided with the test case, which could not be replicated in the CAD data base is as follows:

Aspect: view-dependent line fonts

Reason for non-existence in data base: not supported by CAD system

B. Command Line Syntax

The command line syntax used to pre-process the CAD file is: OUTPUT IGES <CR>

Did processor abort before completely generating IGES file? no

Processor-generated error/warning message: (no messages)

C. IGES File Analysis

Each aspect of the generated IGES file which has been found not to accurately reflect the CAD data base, the selected class of MIL-D-28000, or to the user-defined requirements is

documented as follows:

Aspect: Entity Use flag, DE field 9C, of 110's is "04"

Document(s) and/or data base which this aspect does not adhere to: Class IV of MIL-D-28000A & data base

In what manner is this aspect non-compliant to the specified document(s) and/or data base? document states flag must not be "04" & these entities are used as geometry in the data base, not as a logical or positional reference for other entities

Aspect: text strings "TOP VIEW", "ISOMETRIC VIEW", "FRONT VIEW", and "RIGHT VIEW" are displaced by 1 inch in negative X direction.

Document(s) and/or data base to which this aspect does not adhere: CAD data base

In what manner is this aspect non-compliant to the specified document(s) and/or data base? displacement of text strings according to representation in data base

VI. Post-Processor Results

A. Command Line Syntax

The command line syntax used to post-process the IGES file is: INPUT IGES <CR>

Did processor abort before completely generating CAD data base? NO

Processor-generated error/warning message: _____

"UNSUPPORTED ENTITY 402 F4 DE 85"

"UNSUPPORTED ENTITY 402 F4 DE 89"

"UNSUPPORTED ENTITY 402 F4 DE 93"

"UNSUPPORTED ENTITY 402 F4 DE 97"

"UNSUPPORTED ENTITY 402 F4 DE 101"

"UNSUPPORTED ENTITY 402 F4 DE 105"

B. CAD Data Base Analysis

Each aspect of the generated CAD data base which has been found not to accurately reflect the IGES file, the selected class of MIL-D-28000, or the user-defined requirements, in the context presented in the IGES file, is documented as follows:

Aspect: All lines were visible and solid in all views.

The document(s) and/or IGES file which this aspect does not adhere to: IGES file

In what manner, including IGES entity type, DE and/or PD line number, and field number if applicable, is this aspect non-compliant? Did not process DE field 6 of the 110's in DE 87, 91, 95, 99, 103 and 107

VII. Attachments

INCIDENT LOG

DoeSystems DoeCADD, version 2.0
IGES version of translators is ASME Y14.26M 1989

Customer: Marzell, Kalstein and Associates
Customer Representative: Jeannie Marzell, 202/555-2321
Location of Testing: MKA, 1519 17th St., Washington, DC 20019
Dates of Testing: February 8-9, 1993

Phase I Testing

Tested to Classes II & IV of MIL-D-28000A, Amend 1 and to "PRODUCT DATA EXCHANGE REQUIREMENTS OF MARZELL, KALSTEIN AND ASSOCIATES"

Concepts emphasized are:
- view/drawing/model relationships
- layering
- visualization techniques

2/8, 0902: APPROVAL
- establishment of CAD system environment
- to create and process IGES files and CAD data bases and to evaluate IGES files
- approved by Mitzi Blattstein, vendor rep.

2/8, 1056: APPROVAL
- list of CAD operator commands
- to create CAD data base
- approved by Mitzi Blattstein, vendor rep.

2/8, 1105: CAD OPERATOR ERROR
- Incorrect: "LINE DRAW - 0.0,0.0 - 22.0,0.0"
- Correct: "LINE DRAW - 0.0,0.0 - 0.0,22.0"
- create left border of drawing format
- had no effect

2/8, 1130: CAD SW CONCERN
- will not permit an "edge of base", a line, to have a dashed font in ISOMETRIC view
- could not find a CAD command to change the appearance of a geometric entity in a single or multiple views
- Beverly Kalstein, CAD operator

2/8, 1132: CAD SW CONCERN
- will not permit another "edge of base", a line, to have a dashed font in ISOMETRIC view
- could not find a CAD command to change the appearance of a geometric entity in a single or multiple views
- Beverly Kalstein, CAD operator

2/8, 1135: CAD SW CONCERN
- will not permit an "edge of face", a line, to be blanked in ISOMETRIC and TOP views
- could not find a CAD command to change the appearance of a geometric entity in a single or multiple views
- Beverly Kalstein, CAD operator

2/8, 1145: CAD SW CONCERN
- will not permit an "edge of face", a line, to have a dashed font in ISOMETRIC view
- could not find a CAD command to change the appearance of a geometric entity in a single or multiple views
- Beverly Kalstein, CAD operator

2/8, 1145: CAD SW CONCERN
- will not permit an "edge of face", a line, to have a dashed font in ISOMETRIC view

- could not find a CAD command to change the appearance of a geometric entity in a single or multiple views
- Beverly Kalstein, CAD operator

2/8, 1150: CAD SW CONCERN
- will not permit a "horizontal cut", a line, to have a dashed font in ISOMETRIC view
- could not find a CAD command to change the appearance of a geometric entity in a single or multiple views
- Beverly Kalstein, CAD operator

2/8, 1152: CAD SW CONCERN
- will not permit another "horizontal cut", a line, to have a dashed font in ISOMETRIC view
- could not find a CAD command to change the appearance of a geometric entity in a single or multiple views
- Beverly Kalstein, CAD operator

2/8, 1200: CAD SW CONCERN
- will not permit a line "on face" to be blanked in all views
- could not find a CAD command to change the appearance of a geometric entity in a single or multiple views
- Beverly Kalstein, CAD operator

2/8, 1201: CAD SW CONCERN
- will not permit another line "on face" to be blanked in all views
- could not find a CAD command to change the appearance of a geometric entity in a single or multiple views
- Beverly Kalstein, CAD operator

2/8, 1203: CAD SW CONCERN (see 2/8, 1201 above)

2/8, 1204: CAD SW CONCERN (see 2/8, 1201 above)

2/8, 1225: CAD SW CONCERN
- entity use flag of all 110's is "04" in resulting IGES file
- CAD data base was pre-processed, generating an IGES file with all 110-type entities erroneously flagged as logical/ positional use, which is incompliant with Class IV of MIL-D-28000A and do not reflect nature of those entities as represented in the CAD data base
- Amand Fried, CAD/IGES evaluator

2/8, 1240: CAD SW CONCERN
- displacement of text strings
- text strings "TOP VIEW", "RIGHT VIEW", "FRONT VIEW" and

"ISOMETRIC VIEW" are displaced by 1 inch in the negative X direction in the IGES file
- Amand Fried, CAD/IGES evaluator

2/9, 0753: ERROR
- software which generated error is DoeCADD
- event was post-processing IGES file
- message: "UNSUPPORTED ENTITY 402 F4 DE 85"
- no other event info to be reported
- message was generated six times
- after the first message, the following DE records were specified as presenting unsupported entity type 402 form 4: 89, 93, 97, 101, and 105
- no view-specific entity presentation attributes, such as line fonts and blanking, due to unsupported entities
- Beverly Kalstein, CAD operator

2/9, 0805: DATA BASE QUERY SYNTAX
- command line syntax is "QUERY <CR>"

2/9, 0820: CAD SW CONCERN
- absence of view-specific entity presentation attributes
- all view specific information, represented by instances of entity type 402 form 4 in DE records 85, 89, 97, 101 and 105, were not conveyed during post-processing
- Amand Fried, CAD/IGES evaluator

2/9, 0900: APPROVAL
- discontinuation of software testing
- software could not comply with entity visualization criteria found in user-defined requirements
- Jeannie Marzell, Customer rep.

ENTITY USAGE LOG

DoeSystems DoeCADD, version 2.0
IGES version of translators is ASME Y14.26M 1989

Concepts under test:
- view/model/drawing relationships
- layering
- visualization techniques

MIL-D-28000A, Classes II and IV, and "PRODUCT DATA EXCHANGE REQUIREMENTS FOR MARZELL, KALSTEIN AND ASSOCIATES"

Customer: Marzell, Kalstein and Associates
Testing Administrator: GiGi Arnone, 202/555-2322

Applicable

	COMMAND	ENTITIES
CREATE		
	TEXT	text strings
	LINE - DRAW	lines (annotation)
MODIFY		
	DELETE	lines

Not Applicable

	COMMAND	ENTITIES
CREATE	LINE - MODEL	lines (model)
MODIFY	MOVE	text strings